

OBSERVATIONS ON DROSOPHILA GIVEN A HIGH DOSE OF PROTONS

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Inseminated females of a strain of *D. melanogaster* homozygous for dumpy were exposed in three sets of 100 each to 30,000 rads of 50 Mev protons, a week after eclosion and three days following mating. Each set was transferred to a separate bottle immediately following treatment, and two hours later all the flies were parceled out into nine vials. These P_1 were transferred to fresh food about every three days. Some were remated after three days to compare the fertility of females having fresh sperm to those having only the original irradiated sperm.

The flies were very lethargic after the irradiation but recovered in a few hours. While many eggs were laid in the early broods, only four hatched. Neither the flies with fresh sperm nor those with treated sperm produced any larvae after the third day, indicating heavy damage to the oocytes and ogonia. Three larvae from the second brood of one set pupated, but these died before eclosion. One larva from the first (two hour) brood of another set produced a phenotypically normal female which eclosed much later than normal. This single F_1 offspring when mated to untreated males gave 49 F_2 males and 50 F_2 females. All four expected classes were present in the second generation in roughly equal numbers, and no evidence for radiation induced mutation was found.

It is extremely unlikely that the irradiation was so non-uniform that any of the flies escaped the high dose of 30,000 rads. The proton beam was scattered by 1/8" of carbon to produce a nearly constant flux over a circle of diameter 1 1/2", and only the central 1" disk was used. In addition, the beam was oscillated rapidly (several hundred cps) to smooth out any minute irregularities. The dose delivered corresponds to approximately 1260 protons per square micron, so that each chromosome should have received multiple hits.

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The median life of the flies after this dose of protons was shorter than normal, half dying in 18 days compared to the shortest period of 21 days observed for virgins under similar crowded conditions. Fourteen days after eclosion 222 of the original 300 were alive, 172 lived 17 days, 121 lived 20 days and 3 were alive at an age of 32 days. The food was rather damp and since this dumpy strain gets stuck easily, the environmental conditions may have affected the lifetime more than the radiation. Consequently we conclude from this series only that the sterilizing effect was virtually complete.

Degenerative effects associated with high radiation doses were evident in five flies sacrificed for histological studies. Two flies dissected 17 days after treatment had degenerate ovaries and their oogonia were vacuolated and necrotic. Live motile sperm were seen in the seminal receptacle of the fly taken from a vial with mates, while no sperm were found in one which had been without mates for a week. The three flies which lived 32 days were dissected, and showed more advanced degeneration of the ovaries and the oogonia than the younger pair. No sperm were seen in these flies, which had been without mates for 10 days. Further work with lower doses has suggested other non-reparable damage produced by protons, and some biochemical effects on the brain of adults are being investigated.

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